Damage assessment of a mountain pine beetle infestation, Targhee National Forest, Idaho

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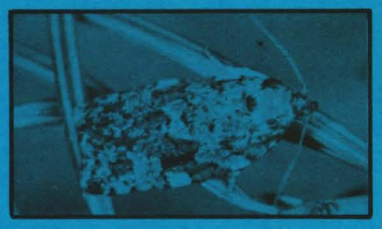

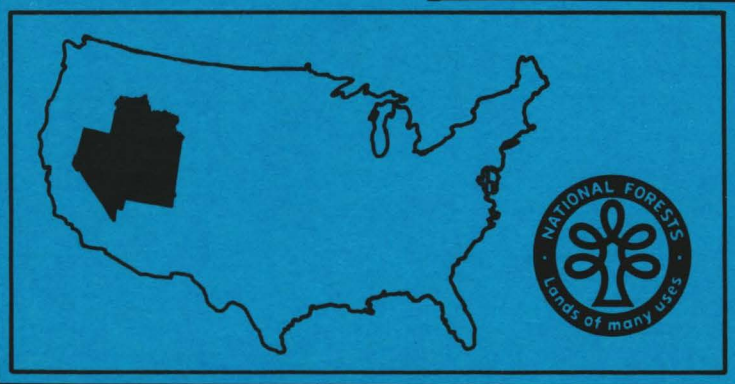

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# DAMAGE ASSESSMENT OF A MOUNTAIN PINE BEETLE INFESTATION, TARGHEE NATIONAL FOREST, IDAHO

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# DAMAGE ASSESSMENT OF A MOUNTAIN PINE BEETLE INFESTATION, TARGHEE NATIONAL FOREST, IDAHO[1/]


## ABSTRACT

Trend studies conducted on the Targhee National Forest, Idaho, indicate that in one stand, during the past five years, 86 trees per acre have been killed by the mountain pine beetle. This represents 69.5 percent of the stand 6 inches dbh and larger. These data could affect management decisions for similar stands of lodgepole pine.


## INTRODUCTION

Infestations by the mountain pine beetle, Dendroctonus ponderosae Hopkins, have apparently occurred periodically throughout the Intermountain Region for as long as there has been lodgepole pine (Roe and Amman, 1970). The present outbreak began in northeastern Utah in the early 1950's and by the mid-1960's reached epidemic proportions in northern Utah, western Wyoming, and the southeastern Idaho (Klein, Stipe, and Frandsen, 1972). As the infestation moved towards Yellowstone National Park in the early 1970's, entomologists began to conduct studies in the Park and adjacent lodgepole stands to determine population trends of the beetle. Trostle (1973) conducted trend and damage assessment studies on the Targhee National Forest, Idaho on the western border of Yellowstone. Parker (1973) and Stipe (1975) carried out similar studies at different elevations within the Park boundaries. These workers, and others, have greatly increased our knowledge concerning the length of an infestation in a given stand and its associated impact.

Of the several National Forests in the Intermountain Region to experience outbreaks by the mountain pine beetle, none has suffered more tree killing than the Targhee National Forest in Idaho. Annual aerial surveys for the past decade show a minimum of 200,000 acres of newly infested lodgepole each year. In 1971, new faders (1970 attacks) covered more than 500,000 acres. During 1977, Forest Insect and Disease Management personnel from the Intermountain Region in Ogden, Utah, and the Methods Application Group in Davis, California, conducted a pilot survey to measure lodgepole mortality through a multistaged sampling system. Preliminary results of that study indicate that in the current infestation on the Eastern Division of the Targhee National Forest 21.3 million trees have been killed by the mountain pine beetle (Klein, Bennett, and Young, 1978). This figure includes only standing dead trees; many thousand, no doubt, have fallen over and were not included in the survey.

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The Island Park Ranger District, being centrally located in the Eastern Division of the Forest, and being comprised primarily of lodgepole pine, has borne the brunt of the current infestation (Figure 1). For this reason it has served as the site for a number of trend studies, preventive spray projects, and impact surveys for the past several years. In June, 1975, an area was selected around the Island Park Ranger Station in which to conduct a continuing series of population trend studies. This report summarizes the data obtained in those studies.

## METHODS

Thirty points were established in a standard grid pattern in an area covering approximately 3,000 acres. The area is roughly rectangular, about two by two and one-half miles with the Island Park Ranger Station being near the center (Figure 2). Each point served as the start of a one-half acre strip plot, one-half chain wide by 10 chains long. The bearing of the plot was determined by the stand at the individual plot. At the terminal end (10-chain point) of each plot, we established a variable cruise plot with a basal area factor of 10. The strip plots were used to measure both past and current mortality, while the variable plots supplied green stand data. Green stand data were collected only during the first year. The strip plots, however, were marked and numbered so they could be cruised each year following the attack period of the beetle.

In the initial cruise in June 1975, the following data were taken from the strip plots: current faders (1974 attacks), old faders (1973 attacks) and snags (attacked prior to 1973). Only those trees 6 inches dbh and larger were recorded. On the variable plots we recorded only green trees of all species six inches dbh and larger.

## DISCUSSION

Green stand data indicate that in 1973, prior to the beetle attack flight, there were 136 live lodgepole per acre, six inches dbh or larger. At the conclusion of the 1977 attack period, only 55.0 green trees per acre remain (Table 1). This indicates 63.3 percent of the stand above five inches dbh has been killed in the past five years. Including snags, those trees killed prior to 1973, 69.5 percent of the stand in this survey area has been killed by the mountain pine beetle. This is one of the highest beetle-mortality areas we have studied during the current infestation.

The infestation, though not over, is subsiding. Table 2 indicates the following attack rates (trees/acre) per year: 1973, 5.7; 1974, 5.8;

1975, 20.9; 1976, 34.6 and 1977, 19.1 (see also Figure 3). The peak year was 1976 when 34.6 trees per acre were attacked (Figure 4). This too is the highest per-acre attack figure we have recorded in the Intermountain Region. Judging from studies conducted in other areas, we predict this infestation will last two to three years more. During this time, an additional 10-15 trees per acre could be killed. There is, at this time, a definite paucity of large trees left in the area--those trees which normally support and maintain a mountain pine beetle population (Figure 5). Still, total mortality could reach 125 trees per acre.

An additional indication of the infestation's trend is the computation of attack ratios. This is done by comparing new attacks in a given year with attacks from the previous year in such a way that the earlier year's attack rate is unity. This measurement also indicates the waning of the infestation: 1974:1973 = 1.02:1; 1975:1974 = 3.60:1; 1976:1975 = 1.66:1; 1977:1976 = 0.55:1. The highest attack ratio; i.e., from 1974 to 1975, corresponds to 1976, the year in which the highest number of trees was killed. Observing the rapid buildup from 1974 to 1975, a nearly four-fold increase, and knowing many more beetles would be present to attack the remaining green component of the stand, we could foresee the following year's extreme mortality.

These data illustrate the effects of the mountain pine beetle in but one part of an overall infestation. To extrapolate these data to any one stand within a forest would likely misrepresent the actual effects on that particular stand. This is, however, an indication of the tree mortality possible where stand conditions permit such population buildups. Green stand data indicate of the 136 trees per acre larger than six inches dbh in 1973, 63.3 percent were eight inches dbh or larger. Amman, et al. (1977) showed that only about 10 percent of the trees smaller than seven inches dbh were attacked in a given infestation, but that the proportion of each succeedingly larger diameter class attacked increased markedly. In a stand susceptibility prediction model, they used average stand diameter as one criterion in rating a given stand for likelihood of a mountain pine beetle infestation. A stand which has an average diameter of eight inches or higher is rated as a high hazard (assuming the elevation-latitude and stand age are also in the established high-hazard range). The average diameter of the trees in this study area in 1973 was 9.1 inches.

Information such as this, that is a history of past beetle activity in a stand of certain parameters, could positively influence stand management decisions. By knowing what beetle activity has occurred in a given stand, the land manager might realistically assume similar beetle activity is possible in another stand of like characteristics. With this information he could alter that stand structure prior to beetle attack, thereby utilizing the larger-diameter trees at a value of green stumpage rates as opposed to those for salvaged dead timber.

## SUMMARY

This assessment indicates that in a period of slightly more than five years, 69.5 percent of this stand six inches dbh and larger was killed by the mountain pine beetle. Though probably representing an extreme case, it does show to what extent the beetle might devastate a stand if the conditions are particularly conducive to rapid buildups. This information could serve as an aid in managing similar stands of lodgepole pine in the Intermountain West.

## REFERENCES


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# APPENDIX

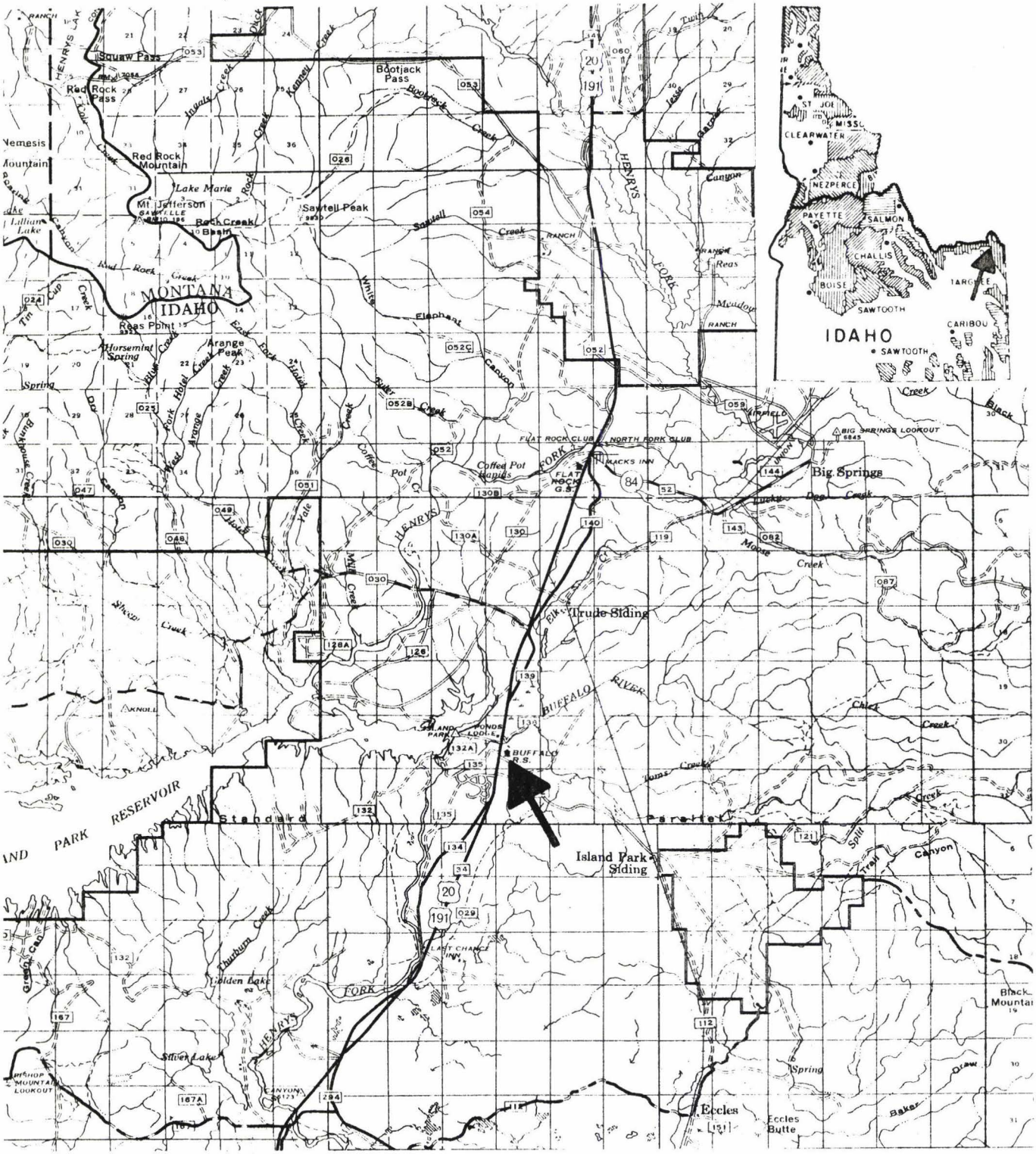


Figure 1. Island Park Ranger District, Targhee N.F.

Figure 2. Location of 30 trend plots surrounding Island Park Ranger Station, Targhee N.F.

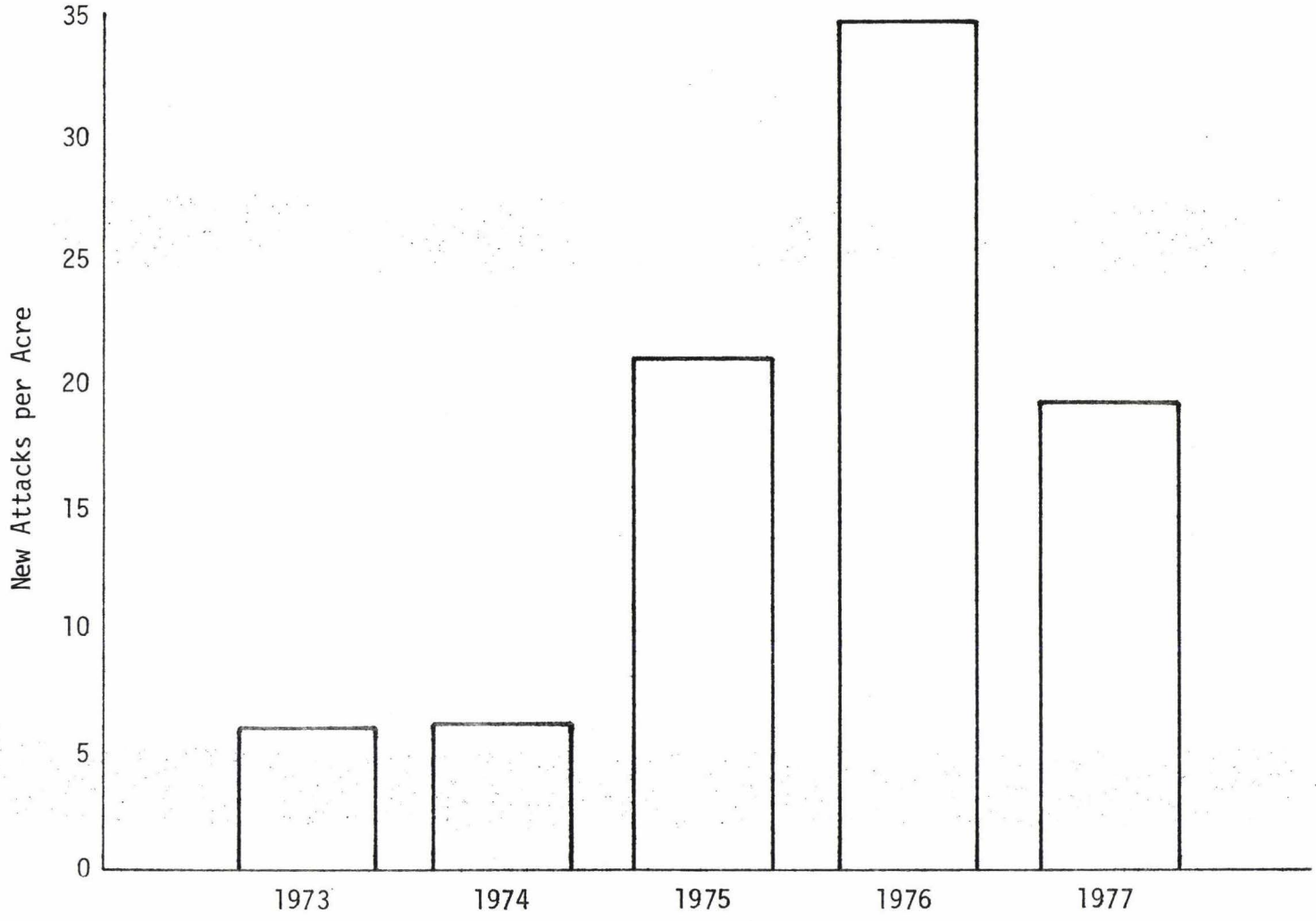


Figure 3. Histogram showing new attacks per acre, 1973-1977, Island Park R.D., Targhee N.F.

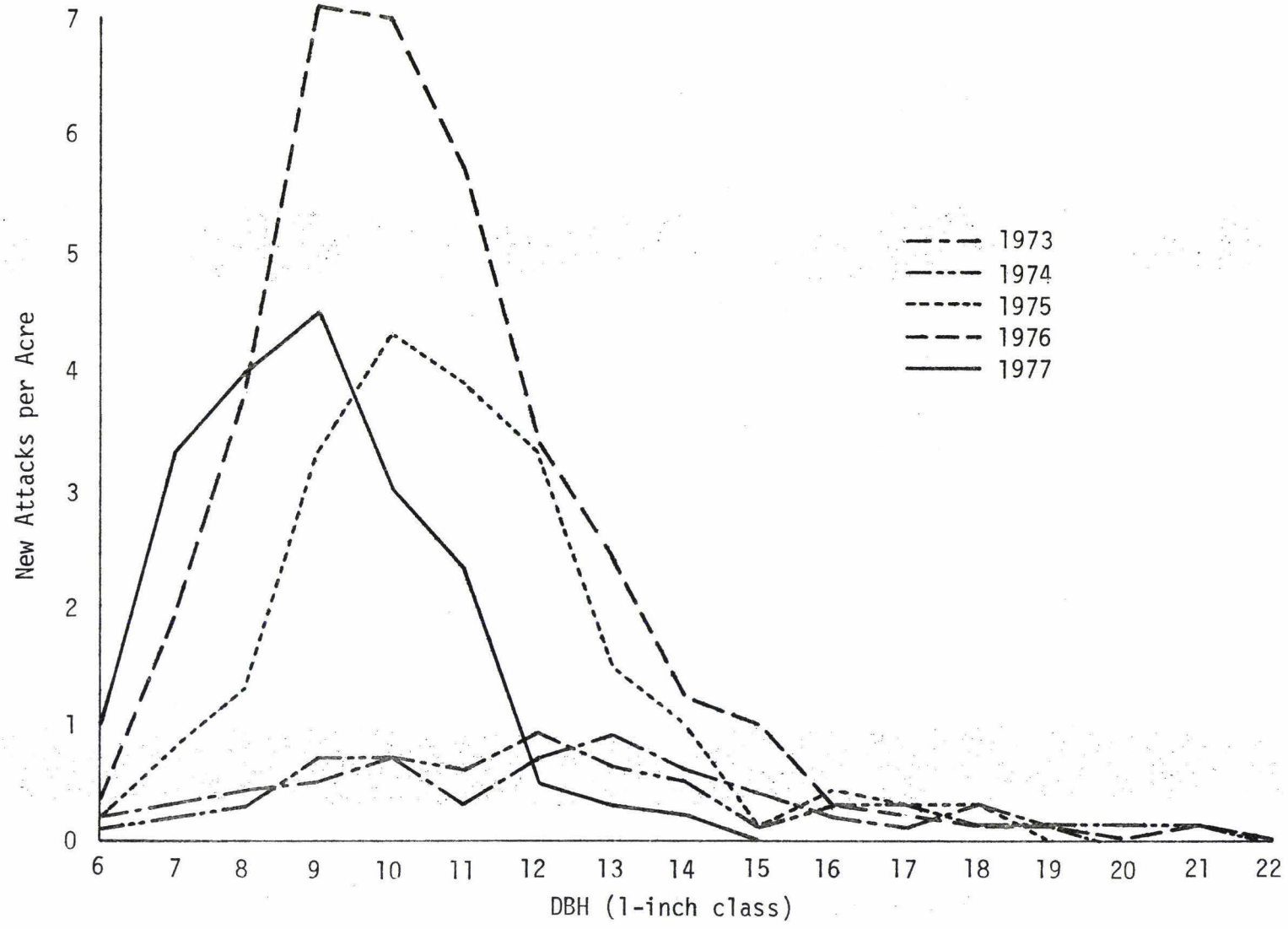


Figure 4. New attacks per acre by diameter class, 1973-1977, Island Park R.D., Targhee N.F.

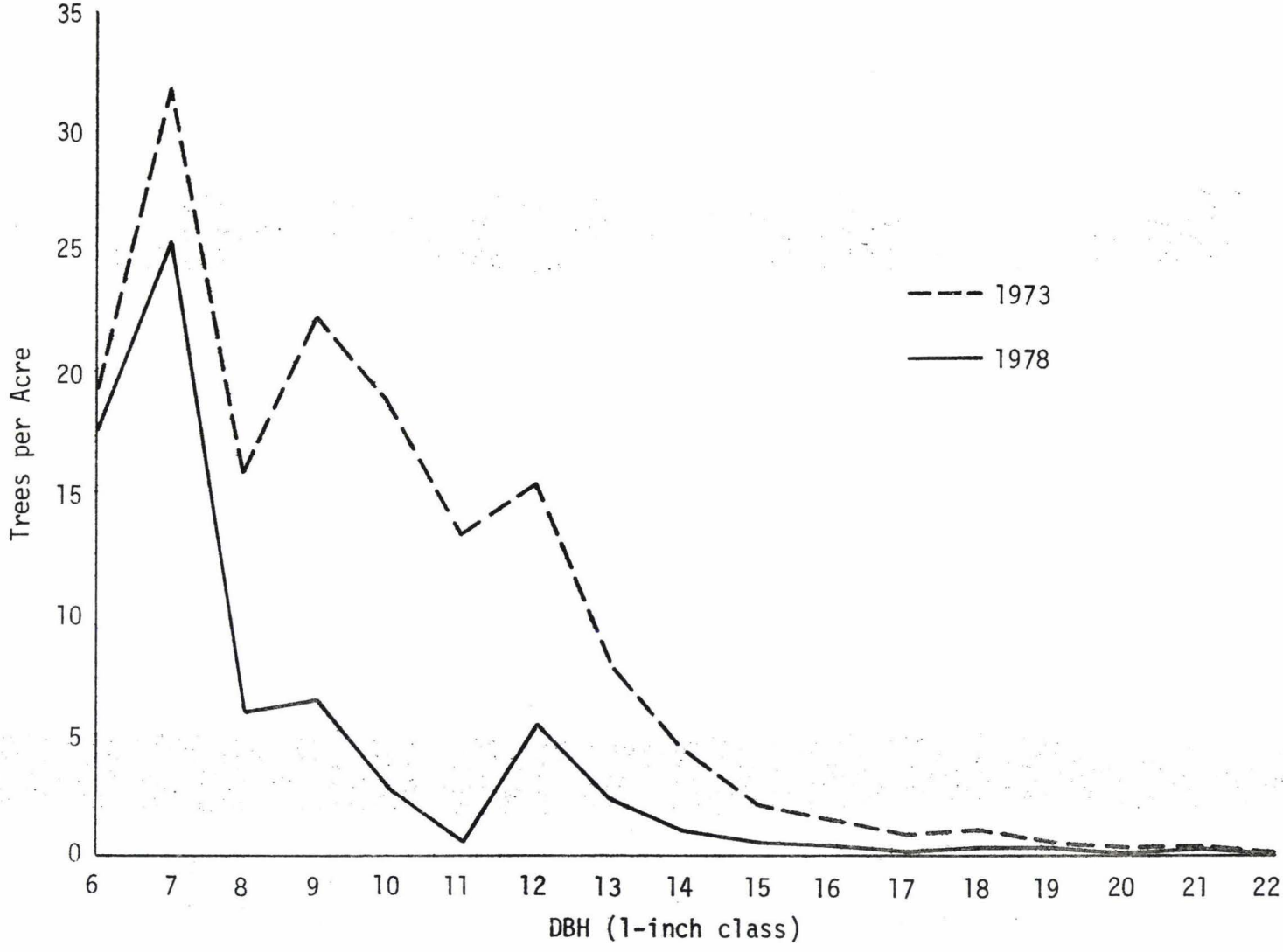


Figure 5. Green stand (trees per acre) in 1973 compared to that remaining in 1978, Island Park R.D., Targhee N.F.

Table 1 - Targhee National Forest Island Park District Buffalo Trend (1973-1977)

Trees Per Acre

| DBH | 1973 Green | 1973 Snags | % Dead 1973 | New Attacks 1973-1977 | % Attacked 1973-1977 | 1978 Green | Total Dead 1978 | % Dead 1978 |
|---|---|---|---|---|---|---|---|---|
| 5.5 - 6.5 | 18.7 | 9.1 | 32.7 | 1.8 | 9.6 | 16.9 | 10.9 | 39.2 |
| 6.5 - 7.5 | 31.2 | 3.5 | 10.1 | 6.5 | 20.8 | 24.7 | 10.0 | 28.8 |
| 7.5 - 8.5 | 14.3 | 3.7 | 20.6 | 9.8 | 68.5 | 4.5 | 13.5 | 75.0 |
| 8.5 - 9.5 | 20.4 | 2.6 | 11.3 | 16.1 | 78.9 | 4.3 | 18.7 | 81.3 |
| 9.5 - 10.5 | 15.9 | 2.3 | 12.6 | 15.7 | 98.7[1] | 0.2[1] | 18.0 | 98.9[1] |
| 10.5 - 11.5 | 11.1 | 1.2 | 9.8 | 12.8 | 100.0[1] | ---[1] | 14.0 | 100.0[1] |
| 11.5 - 12.5 | 12.7 | 1.3 | 9.3 | 8.8 | 69.3 | 3.9 | 10.1 | 100.0[1] |
| 12.5 - 13.5 | 6.1 | 1.3 | 17.6 | 5.7 | 93.4[1] | 0.4[1] | 7.0 | 94.6[1] |
| 13.5 - 14.5 | 2.8 | 0.6 | 17.6 | 3.5 | 100.0[1] | ---[1] | 4.1 | 100.0[1] |
| 14.5 - 15.5 | 1.1 | 0.7 | 38.9 | 1.6 | 100.0[1] | ---[1] | 2.3 | 100.0[1] |
| 15.5 - 16.5 | 0.5 | 0.7 | 58.3 | 1.2 | 100.0[1] | ---[1] | 1.9 | 100.0[1] |
| 16.5 - 17.5 | 0.2 | 0.4 | 66.7 | 0.9 | 100.0[1] | ---[1] | 1.3 | 100.0[1] |
| 17.5 - 18.5 | 0.6 | 0.1 | 14.3 | 0.8 | 100.0[1] | ---[1] | 0.9 | 100.0[1] |
| 18.5 - 19.5 | 0.2 | 0.2 | 50.0 | 0.3 | 100.0[1] | ---[1] | 0.5 | 100.0[1] |
| 19.5 - 20.5 | --- | 0.1 | 100.0 | 0.1 | 100.0[1] | ---[1] | 0.2 | 100.0[1] |
| 20.5 - 21.5 | --- | 0.2 | 100.0 | 0.2 | 100.0[1] | ---[1] | 0.4 | 100.0[1] |
| 21.5 - 22.5 | --- | --- | --- | --- | --- | --- | --- | --- |
| 22.5 - 23.5 | 0.1 | --- | 0.0 | --- | 0.0 | 0.1 | --- | 0.0 |
| 23.5 - 24.5 | 0.1 | --- | 0.0 | 0.1 | 100.0 | --- | 0.1 | 100.0[1] |
| 24.5 - 25.5 | --- | --- | --- | 0.1 | 0.0[1] | ---[1] | 0.1 | 100.0[1] |
| 25.5 - 26.5 | --- | --- | --- | 0.1 | 100.0[1] | ---[1] | 0.1 | 100.0[1] |
| TOTAL | 136.0 | 28.0 | 17.1 | 86.1 | 63.3 | 55.0 | 114.1 | 69.5 |

[1] Figures cannot be accurately compared due to different sampling techniques

Table 2 - Targhee National Forest Island Park District Buffalo Trend (1973-1977)

Trees Per Acre

| DBH | 1973 Total Stand | 1973 Green | 1973 Snags | 1973 Hits | 1974 Hit Strip | | 1975 Hit Strip | | 1976 Hit Strip | | 1977 Hit Strip | | 1973-1977 Total Dead |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.5 - 6.5 | 27.8 | 18.7 | 9.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.3 | 0.4 | 1.0 | 0.5 | 1.8 |
| 6.5 - 7.5 | 34.7 | 31.2 | 3.5 | 0.3 | 0.2 | 0.1 | 0.8 | 0.4 | 1.9 | 0.6 | 3.3 | 0.9 | 6.5 |
| 7.5 - 8.5 | 18.0 | 14.3 | 3.7 | 0.4 | 0.3 | 0.7 | 1.3 | 0.1 | 3.8 | 1.2 | 4.0 | 1.1 | 9.8 |
| 8.5 - 9.5 | 23.0 | 20.4 | 2.6 | 0.5 | 0.7 | 0.7 | 3.3 | 1.1 | 7.1 | 1.4 | 4.5 | 0.6 | 16.1 |
| 9.5 - 10.5 | 18.2 | 15.9 | 2.3 | 0.7 | 0.7 | 1.3 | 4.3 | 1.1 | 7.0 | 1.2 | 3.0 | 0.6 | 15.7 |
| 10.5 - 11.5 | 12.3 | 11.1 | 1.2 | 0.3 | 0.6 | 1.2 | 3.9 | 0.7 | 5.7 | 1.0 | 2.3 | 0.1 | 12.8 |
| 11.5 - 12.5 | 14.0 | 12.7 | 1.3 | 0.7 | 0.9 | 0.9 | 3.3 | 0.2 | 3.4 | 0.3 | 0.5 | --- | 8.8 |
| 12.5 - 13.5 | 7.4 | 6.1 | 1.3 | 0.9 | 0.6 | 0.3 | 1.5 | 0.2 | 2.4 | 0.1 | 0.3 | --- | 5.7 |
| 13.5 - 14.5 | 3.4 | 2.8 | 0.6 | 0.6 | 0.5 | 0.5 | 1.0 | 0.1 | 1.2 | 0.1 | 0.2 | --- | 3.5 |
| 14.5 - 15.5 | 1.8 | 1.1 | 0.7 | 0.4 | 0.1 | 0.4 | 0.1 | --- | 1.0 | --- | --- | --- | 1.6 |
| 15.5 - 16.5 | 1.2 | 0.5 | 0.7 | 0.2 | 0.3 | 0.3 | 0.4 | 0.1 | 0.3 | --- | --- | --- | 1.2 |
| 16.5 - 17.5 | 0.6 | 0.2 | 0.4 | 0.1 | 0.3 | 0.1 | 0.3 | --- | 0.2 | --- | --- | --- | 0.9 |
| 17.5 - 18.5 | 0.7 | 0.6 | 0.1 | 0.3 | 0.1 | --- | 0.3 | 0.1 | 0.1 | --- | --- | --- | 0.8 |
| 18.5 - 19.5 | 0.4 | 0.2 | 0.2 | 0.1 | 0.1 | --- | --- | --- | 0.1 | --- | --- | --- | 0.3 |
| 19.5 - 20.5 | 0.1 | --- | 0.1 | --- | 0.1 | --- | --- | --- | --- | --- | --- | --- | 0.1 |
| 20.5 - 21.5 | 0.2 | --- | 0.2 | --- | 0.1 | --- | --- | --- | 0.1 | --- | --- | --- | 0.2 |
| 21.5 - 22.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22.5 - 23.5 | 0.1 | 0.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 23.5 - 24.5 | 0.1 | 0.1 | --- | --- | --- | --- | 0.1 | --- | --- | --- | --- | --- | 0.1 |
| 24.5 - 25.5 | --- | --- | --- | --- | 0.1 | --- | --- | --- | --- | --- | --- | --- | 0.1 |
| 25.5 - 26.5 | --- | --- | --- | --- | --- | --- | 0.1 | --- | --- | --- | --- | --- | 0.1 |
| TOTAL | 164.0 | 136.0 | 28.0 | 5.7 | 5.8 | 6.6 | 20.9 | 4.1 | 34.6 | 6.3 | 19.1 | 3.8 | 86.1 |